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(52) UK CL (Edition K)
F4S S5E3 S5F

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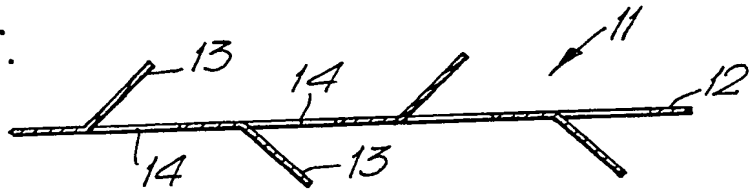
(54) Heat exchangers

(57) An insert for a heat exchanger is in the form of a strip (12) of material which has a plurality of flap members (13) formed therein and angled outwardly to leave holes (14) in the strip. Adjacent flaps (13) are angled in opposite directions relative to the strip. A strip may be positioned internally or externally of fluid passage tubes.

Fig.1c.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1a.

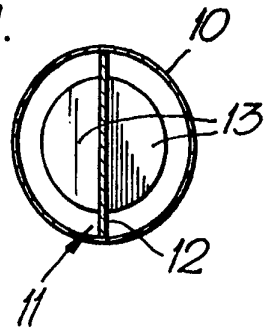


Fig.1b.

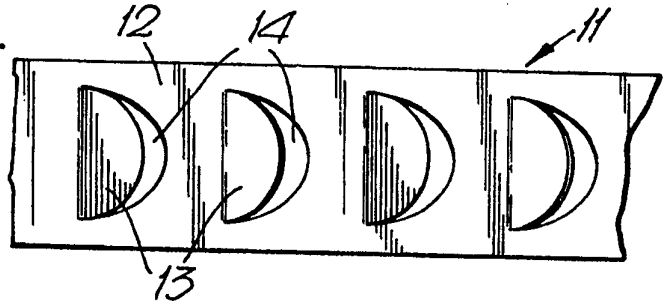


Fig.1c.

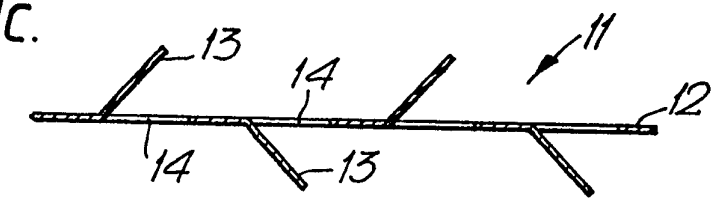


Fig.2.

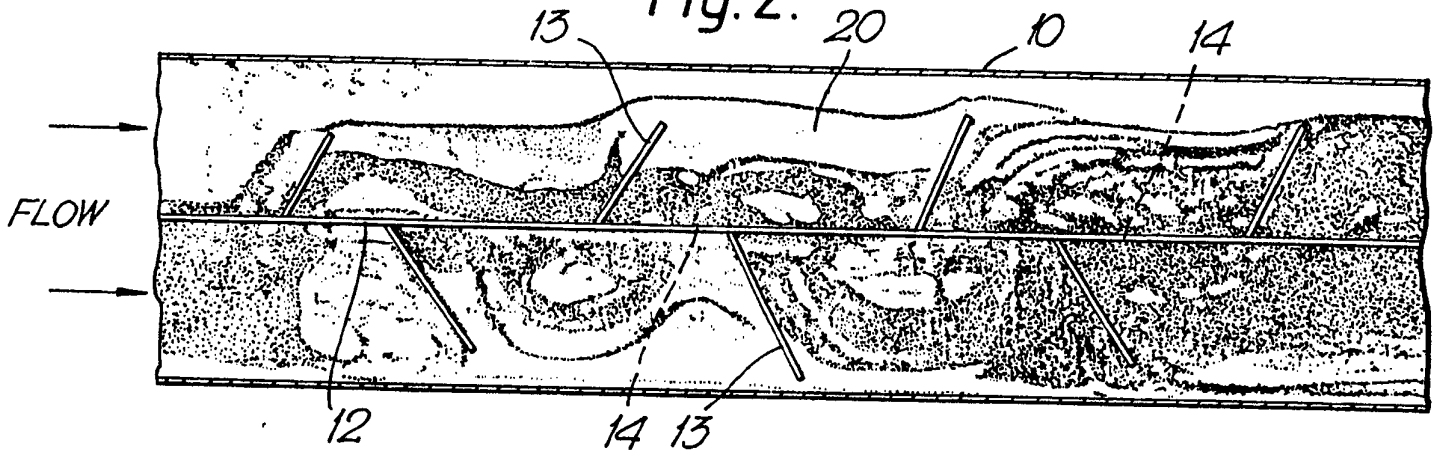


Fig. 3a

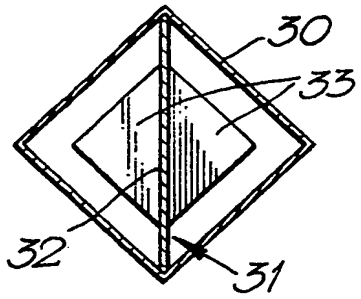


Fig. 3b.

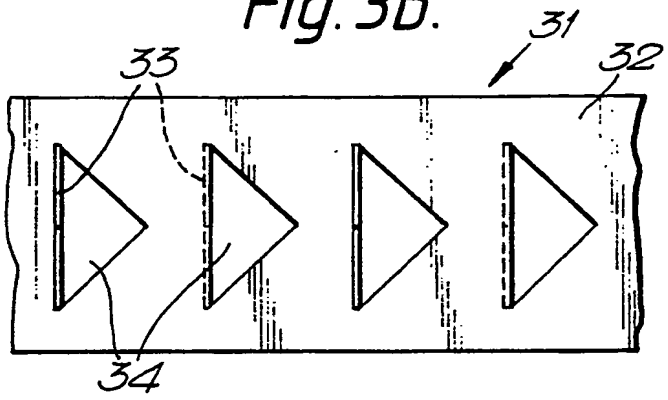


Fig. 3c.

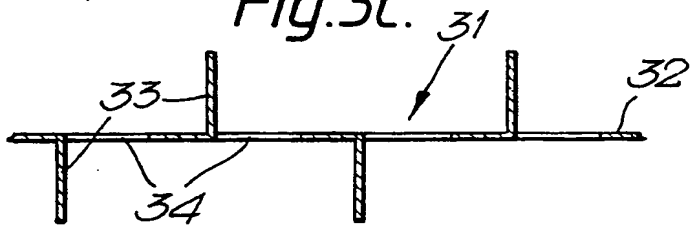


Fig. 4a.

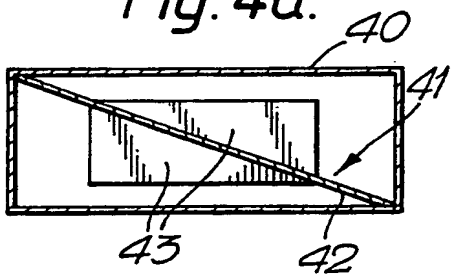


Fig. 4b.

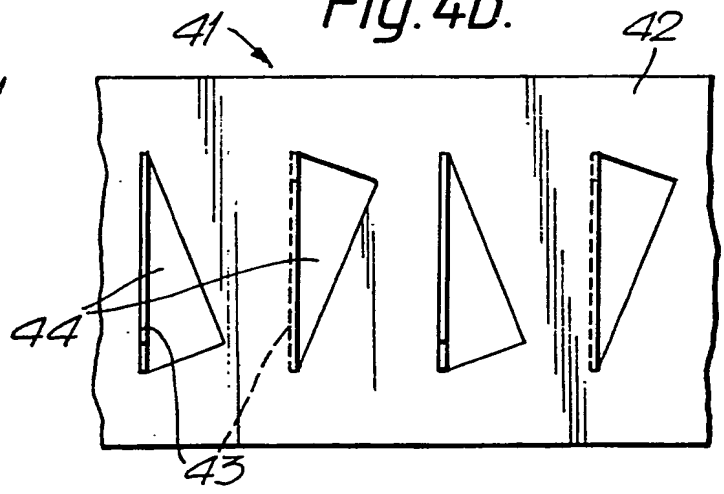


Fig. 4c.

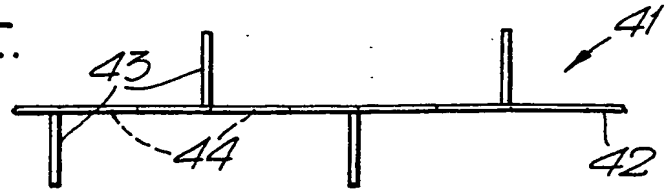


Fig.5a.

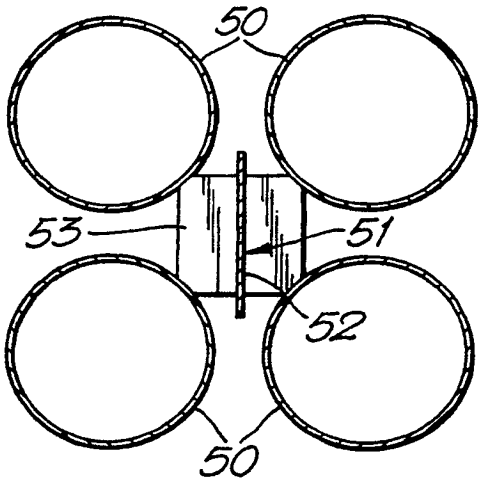


Fig.5b.

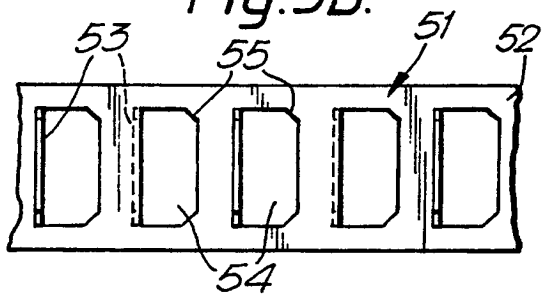


Fig.5c.

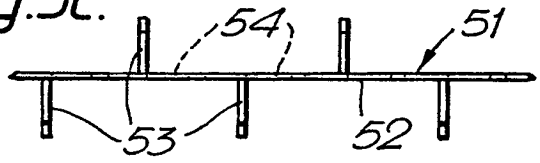


Fig.6a.

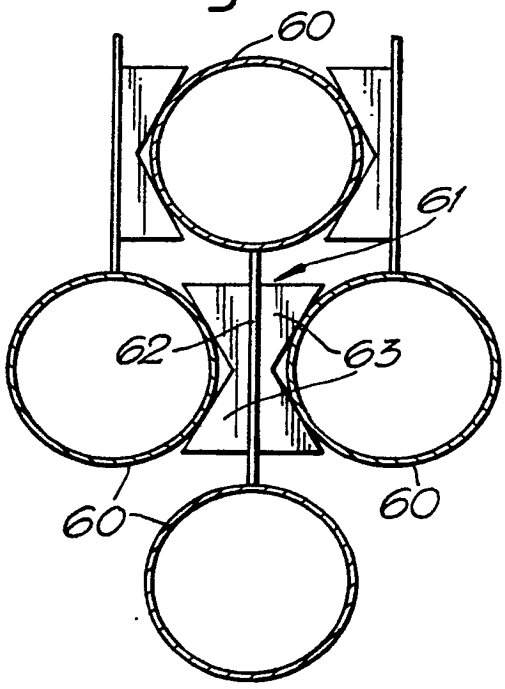


Fig.6b.

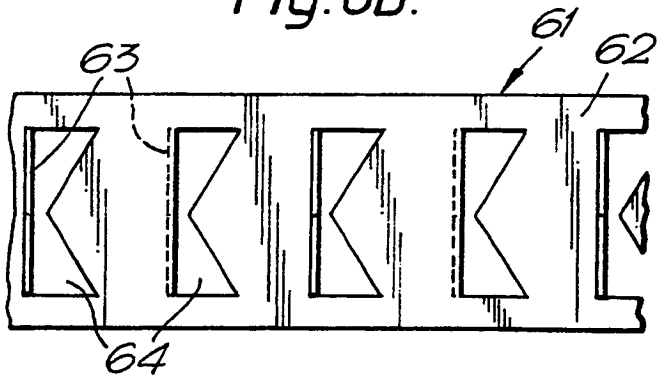


Fig.6c.

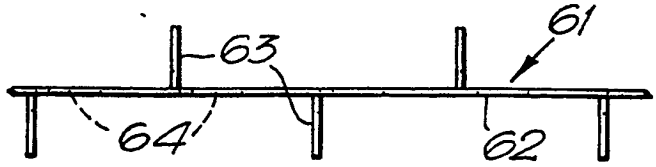


Fig.7a.

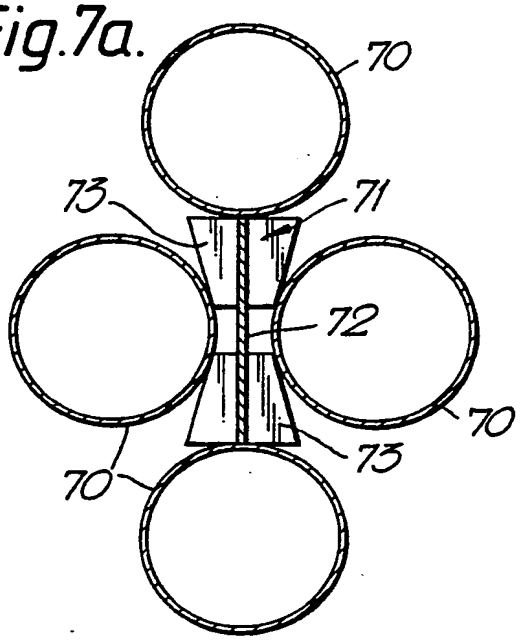


Fig.7b.

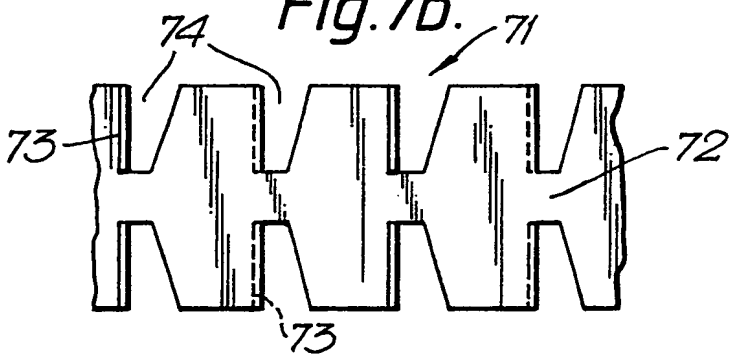
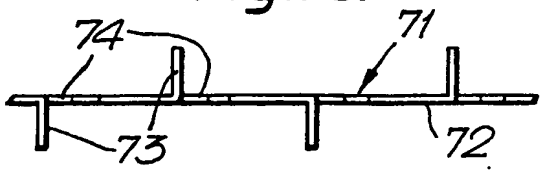


Fig.7c.



SHELL AND TUBE HEAT EXCHANGERS

The present invention relates to heat exchangers for exchanging heat between two fluids one of which flows through the inside of at least one tube outside which the other fluid flows.

Heat exchangers are comparatively bulky items and it is therefore an important factor in their design to maximise the rate of heat transfer between the fluids in order to avoid excessive bulk. However methods of increasing rates of heat transfer usually involve the induction of turbulence in one or both fluids, resulting in increased pressure drop along the fluid flow paths. The presence of a pressure drop indicates a loss of power, and it is also an important factor in heat exchanger design to minimise power losses.

In one known method of increasing heat transfer twisted tapes or coiled wires of various forms are inserted in tubes through which fluid flows. The heat transfer of tubes with such inserts can be improved by a factor of up to 5, but at the cost of a pressure drop which is increased by a factor of up to 100. In another method rods are fitted to extend across tubes. With this arrangement the heat transfer characteristics can be improved by a factor of the order of 2, with the pressure drop being increased by a factor of up to 50.

The present invention provides an alternative type of mixing device which can be used to increase the turbulence either of fluid flowing within a tube or of fluid flowing outside a tube.

According to the present invention an insert for a heat exchanger is in the form of a strip of material having flap members formed therein and angled outwardly therefrom to leave holes in the strip, adjacent flaps being angled in opposite directions relative to the strip.

In one form of heat exchanger including the invention at least one tube has a strip therein.

In another form of heat exchanger incorporating the invention a plurality of tubes have strips according to the invention positioned there-between. In this form of the invention the flaps are preferably arranged to at least partially support and space the tubes.

Some embodiments of the invention will now be described by way of example only, with reference to the accompanying diagrammatic

drawings of which

Figure 1a is an end view, in section, of a circular tube carrying an insert according to the invention,

Figure 1b is a side elevation of the insert,

Figure 1c is a plan view of the insert,

Figure 2 is a plan view, in section, of the tube of Figure 1a with fluid flow there through,

Figures 3a, 3b and 3c illustrate a square section tube and insert corresponding to the arrangement of Figure 1,

Figures 4a, 4b and 4c illustrate a rectangular tube corresponding to Figures 1,

Figure 5a shows an end view in section of a multitube and shell heat exchanger,

Figure 5b is a side elevation of an insert for the heat exchanger of Figure 5a,

Figure 5c is a plan view of the insert shown in Figure 5b, and

Figures 6a, 6b, 6c and 7a, 7b and 7c are alternative forms of multitube and shell heat exchangers.

A tube (Figure 1a) for use in a heat exchanger has a circular shell 10 in which is positioned an insert 11. The insert 11 (Figures 1b, 1c) consists of a strip 12 of material in which semi-circular flaps such as those shown at 13 are punched and angled, adjacent flaps in opposite directions (see Figure 1c), relative to the strip 12 to leave holes 14 in the strip 12.

In use the tube 10 is positioned to form part of a heat exchanger and fluids whose heats are to be exchanged are passed respectively inside and outside the tube. As shown in Figure 2 the presence of the flaps 13 and holes 14 results in turbulence in fluid 20 flowing within the tube 10.

In an alternative form of tube (Figures 3a, b, c) a square tube 30 has an insert 31 in which a strip of material 32 has flaps 33 of isosceles triangle form cut out and angled back to leave holes 34.

In yet another form of tube (Figures 4a, b, c) a rectangular tube 40 has an insert 41 in which a strip of material 42 has triangular flaps 43 formed and angled back to leave holes 44.

In another form of heat exchanger (Figure 5a) a plurality of tubes, of which 4 are shown at 50, are symmetrically situated in a shell and tube heat exchanger and have inserted between them inserts, of which one is shown at 51. Each insert 51 (Figures 5b, 5c) consists of a strip of material 52 in which flaps 53 are formed and angled back to leave holes 54. The edges of the flaps 53 are contoured as shown at 55 to the shape of the tubes 50 such that with the insert 51 in position between tubes 50 the flaps 53 contact the tubes 50 assisting in heat transfer and also in supporting and spacing the tubes 50.

Similar arrangements of a plurality of tubes in a shell and tube heat exchanger, with differing geometrical arrangements of the tubes, are shown in Figures 6a, b, c and Figures 7a, b, c respectively, like items being numbered similarly to those shown in Figures 5. In Figures 6 the flaps have V-shaped notches therein in which tubes 60 are positioned whilst other tubes 60 rest against the sides of the strip 62. In the embodiment of Figure 7 flaps 73 are formed at the edges of the strip 72.

It will be realised that many different embodiments of the invention are possible within the scope of the invention. For example the flaps 13, 33, 43, 53, 63 and 73 may lie at any convenient angle to the strip of material 12, 32, 42, 52, 62 or 72. Various shapes and sizes of flaps may be used. Also whilst the flaps in the various embodiments illustrated and described are shown as being regularly spaced along strips, this need not necessarily be so. Flaps may be more closely spaced towards one end of a strip. Also the shape of flaps and their angles relative to the strip, may be varied along the length of a strip.

CLAIMS

What is claimed is

1. An insert for a heat exchanger in the form of a strip of material having flap members formed therein and angled outwardly therefrom to leave holes in the strip, adjacent flaps being angled in opposite directions relative to the strip.

2. An insert as claimed in Claim 1 wherein the flap members are regularly spaced along the length of a strip.

3. An insert as claimed in Claim 1 or in Claim 2 wherein the flap members are all of the same shape.

4. An insert as claimed in any one of Claims 1 to 3 wherein the flap members are all at the same angle relative to the strip.

5. A heat exchanger having at least one tube containing internally an insert as claimed in any one of Claims 1 to 4.

6. A heat exchanger having a plurality of tubes with inserts as claimed in any one of Claims 1 to 4 positioned therebetween.

7. A heat exchanger as claimed in Claim 6 wherein the inserts at least partially support and space the tubes.

8. An insert for a heat exchanger substantially as herein described.

9. An insert for a heat exchanger substantially as herein described with reference to Figures 1 to 7 of the accompanying drawings.

10. A heat exchanger substantially as herein described.

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